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**Stauter**

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(54) **HEAT DEFLECTOR FOR TRACTOR-TRAILER REFRIGERATION SYSTEM**

(58) **Field of Classification Search**  
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See application file for complete search history.

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*Primary Examiner* — Bryan Evans

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**F25B 39/04** (2006.01)

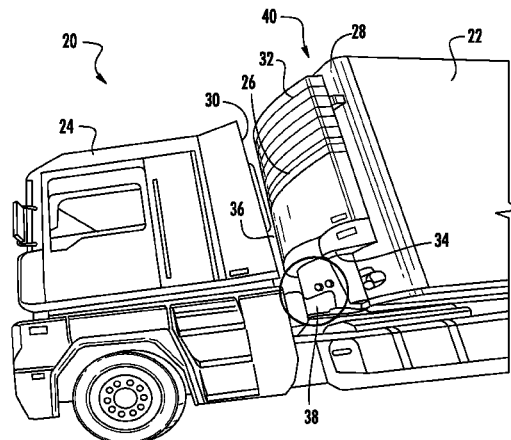
(57) **ABSTRACT**

(52) **U.S. Cl.**

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A transport refrigeration system is provided including a tractor vehicle having an engine and a trailer operably coupled to the tractor vehicle. A transport refrigeration unit is mounted to a front surface of the trailer adjacent the tractor vehicle. At least one shield is mounted to the tractor or the trailer and is configured to divert discharged hot air from a flow path towards a condenser air inlet of the transport refrigeration unit.

**14 Claims, 2 Drawing Sheets**



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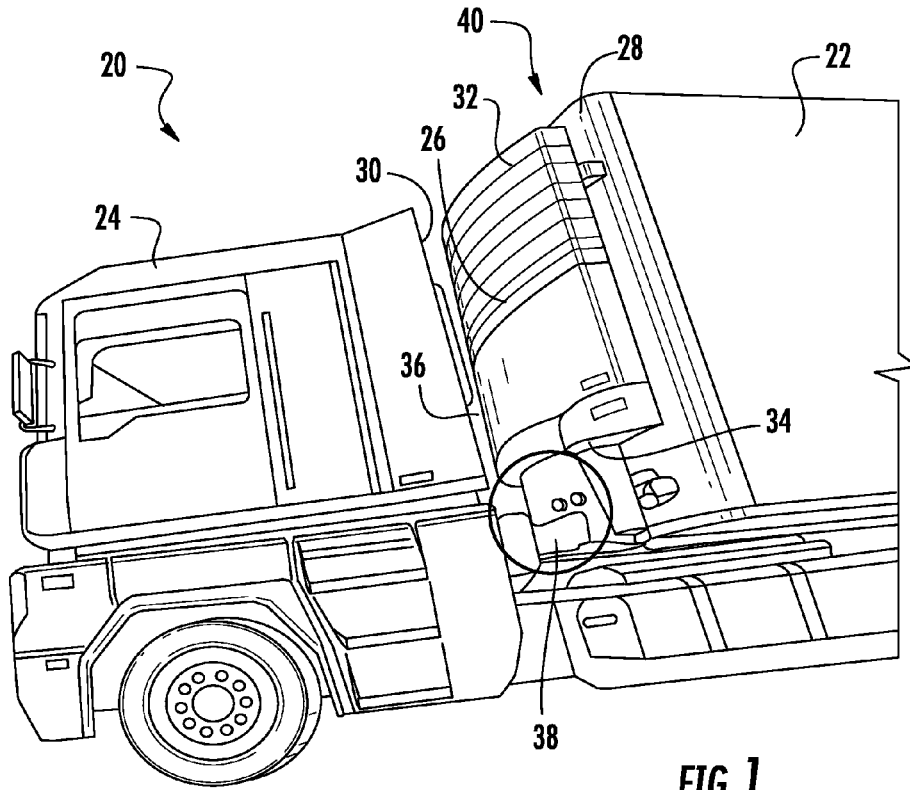


FIG. 1

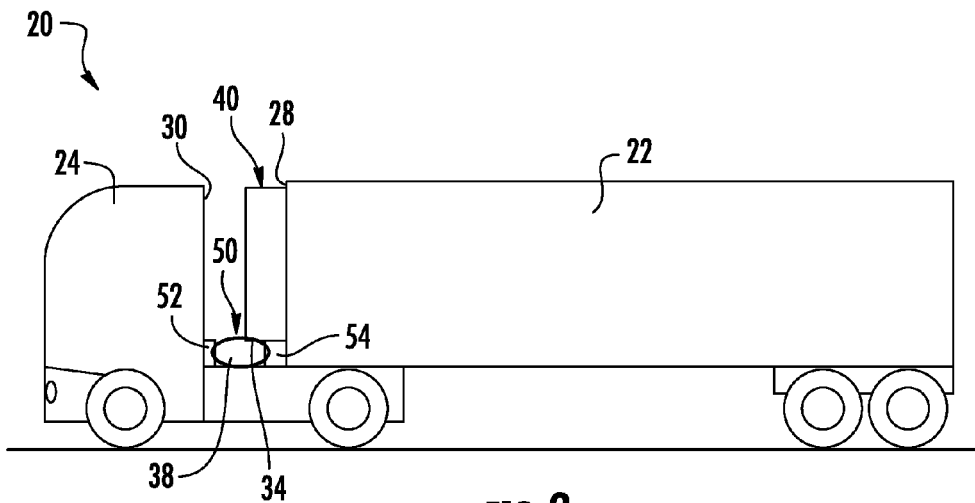
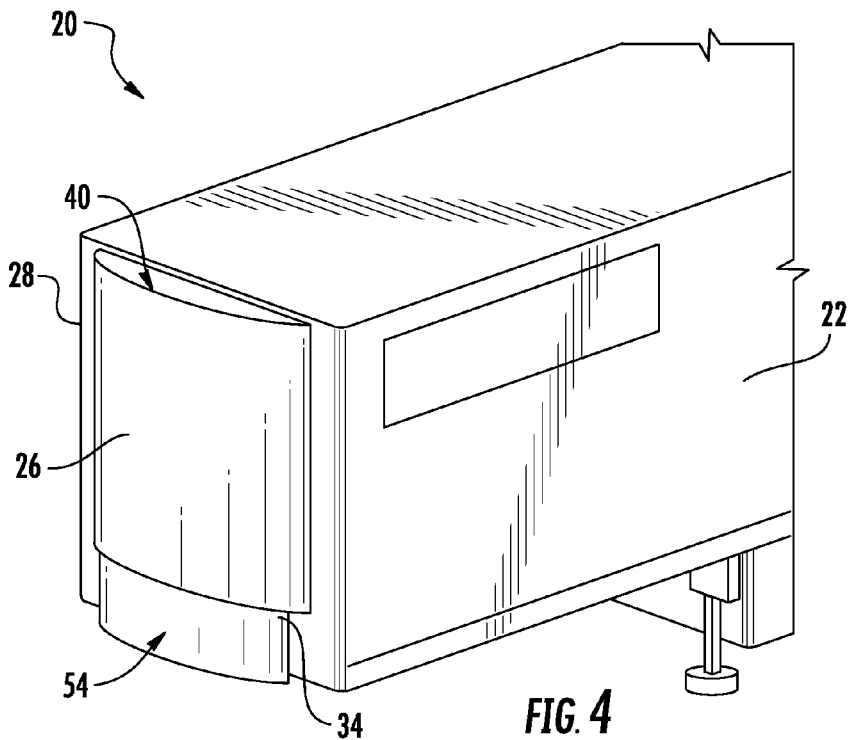
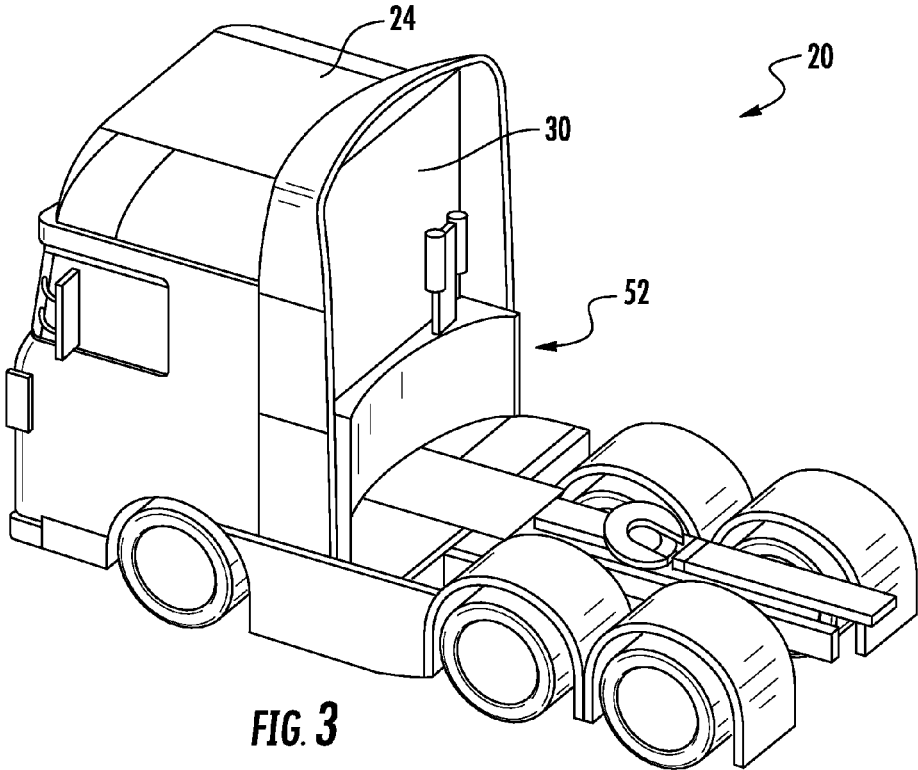


FIG. 2



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## HEAT DEFLECTOR FOR TRACTOR-TRAILER REFRIGERATION SYSTEM

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional patent application Ser. No. 62/135,777, filed Mar. 20, 2015, the entire contents of which are incorporated herein by reference.

### BACKGROUND

This invention relates generally to transport refrigeration systems, and more particularly, to heat shields arranged between the tractor and the trailer of a transport refrigeration system.

Refrigerated trucks, trailers, and intermodal containers, collectively mobile refrigeration systems, are commonly used to transport perishable cargo, such as, for example, meat, poultry, dairy products, cut flowers, and other fresh or frozen products, by road, rail, sea, or intermodally. In the case of refrigerated trucks, a transport refrigeration system is mounted to the truck, typically behind the truck or on the roof of the truck for maintaining a controller temperature environment within the cargo box within the truck. In the case of refrigerated trailers, which are typically pulled behind a tractor vehicle, a transport refrigeration system is mounted to the trailer, typically to the front wall of the trailer for maintaining a controlled temperature environment within the cargo box of the trailer.

Conventionally, transport refrigeration systems used in connection with refrigerated trucks and refrigerated trailers include a transport refrigeration unit having a refrigerant compressor, a condenser with one or more associated condenser fans, an expansion device, and an evaporator, with one or more associated evaporator fans, which are connected via appropriate refrigerant lines in a closed refrigerant flow circuit. Air or an air/gas mixture is drawn from the interior volume of the cargo box by means of the evaporator fan(s) associated with the evaporator, passed through the airside of the evaporator in heat exchange relationship with refrigerant whereby the refrigerant absorbs heat from the air, thereby cooling the air. The cooled air is then supplied back to the cargo box.

During operation of the transport refrigeration system, particularly for tractor-trailer systems, hot air from cooling the prime mover of the engine of the tractor is expelled between the tractor and the trailer near the condenser air inlet of the transport refrigeration unit. In addition, hot air is similarly discharged from the bottom of the transportation refrigeration unit. The condenser of the transport refrigeration unit draws in a mixture of the ambient air and the discharged air from both the tractor engine and the trailer refrigeration unit and uses that air mixture to absorb heat from the refrigerant flowing through the condenser. The increased temperature of the discharged air reduces the efficiency of the condenser and therefore the transport refrigeration unit.

### SUMMARY OF THE INVENTION

According to one embodiment of the invention, a transport refrigeration system is provided including a tractor vehicle having an engine and a trailer operably coupled to the tractor vehicle. A transport refrigeration unit is mounted

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to a front surface of the trailer adjacent the tractor vehicle. At least one shield is mounted to the tractor or the trailer and is configured to divert discharged hot air from a flow path towards a condenser air inlet of the transport refrigeration unit.

In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one shield is configured to direct the discharged hot air towards a side of at least one of the tractor and trailer.

In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one shield is a generally hollow duct.

In addition to one or more of the features described above, or as an alternative, in further embodiments shield is configured to form a generally hollow duct when coupled to at least one of the tractor and trailer.

In addition to one or more of the features described above, or as an alternative, in further embodiments wherein the at least one shield is fabricated from plastic.

In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one shield is formed from sheet metal.

In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one shield includes a first shield mounted to the tractor and configured to divert vehicle engine heat towards a side of the tractor.

In addition to one or more of the features described above, or as an alternative, in further embodiments the first shield is generally complementary to one or more components extending from the tractor towards the trailer.

In addition to one or more of the features described above, or as an alternative, in further embodiments the system additionally includes a second shield adjacent a base of the transport refrigeration unit. The second shield is configured to divert hot air discharged from the transport refrigeration unit towards a side of the trailer.

In addition to one or more of the features described above, or as an alternative, in further embodiments the first shield and the second shield have a generally similar contour.

In addition to one or more of the features described above, or as an alternative, in further embodiments the first shield and the second shield do not contact one another when the tractor and trailer are in a linear configuration.

In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one shield includes a first shield mounted adjacent a base of the transport refrigeration unit and configured to divert hot air discharged from the transport refrigeration unit away from the condenser air inlet.

In addition to one or more of the features described above, or as an alternative, in further embodiments the first shield is generally complementary to one or more components extending from the trailer towards the tractor.

In addition to one or more of the features described above, or as an alternative, in further embodiments a second shield is mounted to the tractor and is configured to divert hot air discharged from the vehicle engine towards a side of the tractor.

### BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter, which is regarded as the invention, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the invention are apparent

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from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of an example of a transport refrigeration system;

FIG. 2 is a side view of a transport refrigeration system according to an embodiment of the invention prior to a tractor-trailer turning operation;

FIG. 3 is a perspective view of a heat shield mounted to the tractor of the transport refrigeration system according to an embodiment of the invention; and

FIG. 4 is a perspective view of a heat shield mounted to the trailer of the transport refrigeration system according to an embodiment of the invention.

The detailed description explains embodiments of the invention, together with advantages and features, by way of example with reference to the drawings.

#### DETAILED DESCRIPTION

Referring now to FIG. 1, an example of a transport refrigeration system 20 is illustrated. In the illustrated, non-limiting embodiment, the transport refrigeration system 20 includes a trailer 22 towed or otherwise transported by a tractor 24. The system 20 includes a transport refrigeration unit 40 configured to cool a cargo space of the trailer 22. The transport refrigeration unit 40 is enclosed within an outer cover 26 and attached to a surface 28 of the trailer 22 adjacent the back 30 of the tractor 24. As is common for transport refrigeration systems 20, various panels or other portions of the outer cover 26 may be hinged and/or are removable to provide efficient access to the refrigeration unit 40 to perform routine maintenance.

The transport refrigeration unit 40 is typically powered by an engine (not shown), separate from the engine of the tractor 24, and located behind the lower panels of the transport refrigeration unit 40. The transport refrigeration unit 40 generally comprises a one-piece, self-contained refrigeration/heating unit including an engine, a compressor, a condenser, and an evaporator. In the illustrated, non-limiting embodiment, an air inlet for drawing in ambient air configured to cool the refrigerant or another heat transfer fluid as it flows through the condenser is provided by way of a grill 32 located at the upper portion of the cover 26. The air is configured to remove heat from one or more of the condenser, engine (not shown) and a radiator configured to cool the engine (not shown) in sequence, prior to being discharged from a base 34 of the refrigeration unit 40 (see FIG. 2) adjacent the air gap 36 between the tractor 24 and the trailer 22.

Operation of the tractor 24, more specifically an engine (not shown) thereof, results in generation of heated air from the vehicle engine that must be expelled into the ambient atmosphere outside the tractor 24. In tractor-trailer systems, air from an engine cooling system of the tractor 24 is blown between the tractor cabin 24 and the trailer 22 adjacent the bottom of the refrigeration unit 40. For clarity, this area where the heated air from both the transport refrigeration unit 40 and the engine is expelled is identified in FIGS. 1 and 2 by numeral 38.

Referring now to FIG. 2, one or more shields 50 are configured to divert the discharged hot air from the transport refrigeration unit 40 and/or the vehicle engine away from the air gap between the tractor 24 and the trailer 22. The one or more shields 50 may be formed from any suitable material, including, but not limited to sheet metal or plastic for example. The shields 50 themselves may be baffles or ducts, or alternatively, may be configured to form a duct when

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mounted to one of the tractor 24 and trailer 22. In one embodiment, the at least one shield 50 is configured to divert the heated air discharged from either the transport refrigeration unit 40 or the vehicle engine upwards or downwards and towards the sides of the tractor 24 and the trailer 22. As a result, the at least one shield 50, therefore prevents the warm or hot discharged air from being drawn into the condenser air inlet, thereby improving the operational efficiency of the refrigeration unit 40.

As illustrated in FIGS. 2-4, at least a portion of a first shield 52, such as a vehicle engine heat shield for example, may be mounted to the back surface 30 of the tractor 24 to prevent the discharged hot air from the vehicle engine from becoming entrained in the condenser air inlet via grill 32. Alternatively, or in addition, a portion of a second shield, such as a transport refrigeration unit shield 54, may be mounted to the front surface 28 of the trailer 22 to divert the hot air discharged from the transport refrigeration unit 40 away from becoming entrained in the condenser air inlet via grill 32. The shields 52, 54 may be configured to attach to the tractor 24 and the trailer 22, respectively, via any of a variety of known attachment means, for example a bracket and fasteners or a snap-fit connection. In one embodiment, one or both of shields 52, 54 are mounted to the system 20 in a way that does not interfere with the one or more conduits (not shown), such as brake hoses for example, connecting the tractor 24 and the trailer 22. Although the illustrated transport refrigeration system 20 includes both a first and second shield 52, 54, embodiments having only one of the first shield 52 and the second shield 54 are within the scope of the invention.

The shape and contour of each of the first and second shields 52, 54 is generally similar or complementary to any additional components extending from surface 30 of the tractor 24, or surface 28 of the trailer 22. In addition, the contour of the first shield 52 is generally similar or complementary to the contour of the second shield 54. In the illustrated, non-limiting embodiments of FIGS. 3 and 4, the first shield 52 has a generally concave curvature and the second shield 54 a generally convex curvature such that a portion of the second shield 54 could be received within a portion of the first shield 52. The first and second shield 52, 54 are not configured to contact one another during normal operation of the system 20, for example when the tractor 24 and trailer 22 are in a linear configuration. The contour of the shields 52, 54 may additionally be configured to avoid contact with one another when the system is in a second, non-linear configuration, such as when the tractor 24 is making a turn for example.

Inclusion of one or more shield 50 as described herein will deflect the streams of the hot air to the sides of the tractor 24 and/or trailer 22, so that they do not become entrained in the condenser air inlet. As a result, cooler ambient air will be drawn into the condenser, thereby improving not only the efficiency, and therefore the fuel consumption of the system 20, but also the reliability and the operability thereof.

While the present invention has been particularly shown and described with reference to the exemplary embodiments as illustrated in the drawing, it will be recognized by those skilled in the art that various modifications may be made without departing from the spirit and scope of the invention. Therefore, it is intended that the present disclosure not be limited to the particular embodiment(s) disclosed as, but that the disclosure will include all embodiments falling within the scope of the appended claims.

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We claim:

1. A transport refrigeration system comprising:

a tractor vehicle having an engine;

a trailer operably coupled to the tractor vehicle;

a transport refrigeration unit mounted to a front surface of  
the trailer adjacent the tractor vehicle; and

at least one shield mounted to the tractor or the trailer  
within an air gap defined between the tractor and the  
trailer, the at least one shield being configured to divert  
discharged hot air from a flow path towards a condenser  
air inlet of the transport refrigeration unit.

2. The transport refrigeration system according to claim 1,  
wherein the at least one shield is configured to direct the  
discharged hot air towards a side of at least one of the tractor  
and trailer.

3. The transport refrigeration system according to claim 1,  
wherein the at least one shield is a generally hollow duct.

4. The transport refrigeration system according to claim 1,  
wherein the at least one shield is configured to form a  
generally hollow duct when coupled to at least one of the  
tractor and trailer.

5. The transport refrigeration system according to claim 1,  
wherein the at least one shield is fabricated from plastic.

6. The transport refrigeration system according to claim 1,  
wherein the at least one shield is formed from sheet metal.

7. The transport refrigeration system according to claim 1,  
the at least one shield includes a first shield mounted to the  
tractor and configured to divert vehicle engine heat towards  
a side of the tractor.

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8. The transport refrigeration system according to claim 1,  
wherein the at least one shield is generally complementary  
to one or more components extending from the tractor  
towards the trailer.

9. The transport refrigeration system according to claim 7,  
further comprising a second shield adjacent a base of the  
transport refrigeration unit and configured to divert hot air  
discharged from the transport refrigeration unit towards a  
side of the trailer.

10. The transport refrigeration system according to claim  
9, wherein the first shield and the second shield have a  
generally similar contour.

11. The transport refrigeration system according to claim  
9, wherein the first shield and the second shield do not  
contact one another when the tractor and trailer are in a  
linear configuration.

12. The transport refrigeration system according to claim  
1, the at least one shield includes a first shield mounted  
adjacent a base of the transport refrigeration unit and con-  
figured to divert hot air discharged from the transport  
refrigeration unit away from the condenser air inlet.

13. The transport refrigeration system according to claim  
12, wherein the first shield is generally complementary to  
one or more components extending from the trailer towards  
the tractor.

14. The transport refrigeration system according to claim  
12, further comprising a second shield mounted to the tractor  
and configured to divert hot air discharged from the vehicle  
engine towards a side of the tractor.

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